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EXAMINER	
BLOOM, NATHAN J	

ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/532,438	POTTER ET AL.	
	Examiner	**Art Unit**	
	NATHAN BLOOM	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _10 November 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _61-67,69-77 and 90-99_ is/are pending in the application.

4a) Of the above claim(s) _65 and 73-76_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _61-64, 66-67,69-72, 77, and 90-99_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicants' response to the last Office Action, filed on November 10th, 2008 has been entered and made of record.

Response to Arguments

1. Applicant's arguments filed 11/10/2008 have been fully considered but they are not persuasive.

2. Applicant has argued on pages 2-3 that Trew in view of Hu has not taught a method that "models the aliasing effect" and goes into further detail regarding the non-claimed limitations, and where each is supported within the specification. However, neither the modeling of the aliasing effect nor the related details have been presented as limitations in the currently presented claims. Furthermore, in response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "models the alias effects" and other spurious details) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Additionally, as per the teachings of Trew in view of Hu have taught the Examiner's broadest reasonable interpretation of the currently presented claim language described in the 35 USC 103 claim rejections provided below.

Response to Amendment

3. In response to the cancellation of claim 68, the 35 USC 112 rejection of claim 68 has been withdrawn.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 61, 67, 69-72, 90, and 98 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trew (US 5280530) in further view of Hu (US 6483538).

Instant claim 61: A method for determining coordinates of a feature comprising:

providing a first image including the feature, the first image comprising a plurality of pixels; [*Trew has taught in column 2 line 20-37, column 3 lines 65+, and column 4 lines 20-65 the use of an initial template image including the desired feature.*]

determining a first estimate of coordinates of the feature to within a fraction of a pixel; [*Trew further teaches in the sections referred to above the determination of the coordinates of a feature in a series of images, but does not teach a method of correlation wherein coordinates are determined with subpixel precision. However, Hu teaches in column 2 lines 31-65 the correlation of a pair of images obtained from a test video and captured video by correlation of the images. Furthermore, Hu teaches in column 3 lines 5-20 the measurement of a fractional pixel position and the shifting of the position to a "nearest integer pixel". Although, Hu does not*

clearly state that the initial measurement is to a fraction of a pixel it is implied by the phrase "nearest integer pixel shift" which implies that a measurement of pixel position to a fraction of a pixel value was taken, else it would not be necessary to shift the pixel position to the "nearest integer pixel" and would simply be stated as an integer pixel shift. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the correlation method taught by Trew with the teachings of Hu to increase the accuracy of the positional measurement. Thus Trew in view of Hu has taught the subpixel positioning of a feature within an image using correlation.]

translating the feature relative to the pixels [*Regarding the new limitation: The feature described by Trew in view of Hu is described by pixels, and is shifted in relation to pixels.*] by a pixel translation value, wherein the sum of the pixel fraction and pixel translation value is an integer value; [*Hu teaches in lines 5-20 of column 3 the shift of the measured pixel position to the nearest integer pixel position using the "nearest integer pixel position shift". Thus the shift referred to by Hu is the total shift value that translates the measured fractional pixel value to a "nearest integer pixel", but Hu does not explicitly teach the summation of a translation value to the fractional pixel position measured. However, in order to end up with a shift to a "nearest integer pixel" the fractional value needs to be mathematically manipulated in order to determine the nearest integer value. Examiner takes official notice that one of ordinary skill in the art would have recognized that only a finite number of solutions exist for moving the fractional value to the nearest integer value. The known solutions are rounding the fractional value or adding (or subtracting "add a negative value") the difference value between the fractional value and its nearest integer value. Thus it has been established that Hu teaches shifting of the pixel*

value to the "nearest integer" and that there are only a finite number of solutions for adjusting a fractional value to its closest integer value. A person of ordinary skill in the art at the time of the invention would have had good reason to pursue the known options of shifting to the closest integer value given the teachings of Hu. Furthermore, it would have required no more than "ordinary skill and common sense," to sum the fractional value with a difference value that is equal to the distance between the fractional value and its closest integer value.]

determining a second estimate of coordinates of the translated feature to within a fraction of a pixel; and [*Hu teaches in column 3 lines 21-44 the determination of an additional fractional estimate of coordinates using the translated image.*]

summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates. [*See Hu lines 30-32 of and 38-40 of column 3 ($X_\Delta + X_f$ = first estimate + second estimate).*]

Instant claim 90: A method for determining coordinates of an object, the method comprising the steps of:

capturing at least one first image and at least one second image of the object, each image being captured having different coordinates with respect to the other; [*See the discussion of claim 61, wherein the capturing of a video sequence and the correlation of an image with a feature to at least one other image containing said feature by Trew in view of Hu. Furthermore, the teachings of Hu imply that each image has different coordinate with respect to each other since a specialized system of recording a sequence of images with exactly the same coordinates is not specified (very difficult to capture an image at exactly the same coordinate). Additionally,*

the fact that the object has shifted in each image implies that the coordinate of each image is different.]

determining the position of the object within each image, wherein determining includes; [*See the discussion of claim 61.*]

providing the first image including a feature, the first image comprising a plurality of pixels; [*See the discussion of claim 61.*]

determining a first estimate of coordinates of the feature to within a fraction of a pixel; *See the discussion of claim 61.*]

translating the feature relative to the pixels by a pixel translation value, wherein the sum of the pixel fraction and pixel translation value is an integer value; [*See the discussion of claim 61.*]

determining a second estimate of coordinates of the translated feature to within a fraction of a pixel; [*See the discussion of claim 61.*]

summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates; and [*See the discussion of claim 61.*]

comparing the determined positions of the object to determine dimensional changes. *Trew teaches the measurement of the displacement of the features in column 2 lines 30-40.*]

Instant claim 98: The method of claim 61, wherein the first image is captured with an image capture device. [*As per the discussion of claim 61, both Hu (video test image) and Trew have taught the capturing of the first image with an image capture device.*]

Instant claim 67: The method according to claim 61, wherein the translating step, second determining step and summing step are repeated at least once. [*Hu in column 3 lines 20-45 iterates the algorithm a specified number of iterations and checks the measured value with a noise value.*]

Instant claim 69: An apparatus for determining a position of an object comprising:

an image capture device arranged to provide a captured image encompassing the object, the captured image comprising a plurality of pixels; and [*Trew in lines 45-55 of column 5 describes a camera for capturing the images containing the feature to be tracked.*]

an image processor arranged to receive the captured image and determine the position of the object by executing the method of claim 61. [*Trew in lines 45-55 further describes a means for performing the processing, but does disclose the specific means. However, Hu in figure 1 and column 2 lines 30-50 discloses a video processor for performing the video processing method.*]

Instant claim 70: The apparatus according to claim 69 further comprising:

a monitor arranged to receive and display the captured image; and [*Trew teaches a display means for displaying the images in column 6 lines 25-35.*]

an object selection means arranged to select a further object within the displayed image and to identify the further object to the image processor. [*Trew teaches in column 6 lines 55 the selection (tracing of feature to be used as template) of the template by automatic or manual*

means. Furthermore, Tracing as taught by Trew must be done on a displayed image, and thus Trew teaches a selection means wherein the object is selected within the displayed image.]

Instant claim 71: An apparatus for determining a position of an object comprising:

an image capture device arranged to sequentially provide a plurality of captured images of an object, each captured image comprising a plurality of pixels; and [*Trew in lines 45-55 of column 5 describes a camera for capturing a series of images containing the feature to be tracked.*]

an image processor arranged to sequentially receive the plurality of captured images and determine the position of the object from the plurality of captured images by executing the method of claim 61; and [*Trew in lines 45-55 further describes a means for performing the processing, but does disclose the specific means. However, Hu in figure 1 and column 2 lines 30-50 discloses a video processor for performing the video processing method.*]

a position comparator arranged to compare the determined position of the object for the plurality of captured images and identify whether the determined position changes in the plurality of captured images. [*Trew teaches the measurement of the displacement of the features in column 2 lines 30-40.*]

Instant claim 72: The apparatus according to claim 71 further arranged to determine the change in the determined position, the change selected from the group consisting of magnitude, direction, and combinations thereof. [*Trew teaches the measurement of the displacement*

(displacement is magnitude of positional change, but also includes directional information for tracking) of the features in column 2 lines 30-40.]

6. Claims 91 and 99 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trew in view of Hu as applied to claim 61 above, and further in view of Torre-Bueno et. al. (US 2003/0231791). 2002/0044682

Instant claim 91: The method of claim 61, wherein the refined estimate of coordinates is recorded on a computer readable medium. [*Trew in view of Hu have taught the detection of a feature using correlation, and the measurement of the shift and position in the image, but have not taught the store of the positional information. However, Torre-Bueno has taught in paragraph 0070 the measurement of an objects location in an image and the storage (on a computer readable medium) of the information for later using in processing the information. It would have been obvious to one of ordinary skill in the art to modify the teachings of Trew in view of Hu (object detection and subpixel positional measurement) with the teachings of Torre-Bueno to store the information for later use.*]

Instant claim 99: The method of claim 90, wherein the coordinates are recorded on a computer readable medium. [*See the discussion of claim 91.*]

7. Claims 92-97 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trew in view of Hu as applied to claim 61 and 90 above, and further in view of Well et. al. (US 2002/0044682).

Instant claim 92: The method of claim 90, further comprising determining a 2-dimensional position of the feature within the at least first image and the at least second image, wherein a position of the at least second image is known relative to the at least first image. [*Trew in view of Hu has taught the positional determination of an object from one image in the other image (second image), but has not taught that the position of the at least second image is known related to the first image. However, Well has taught the positioning of stereoscopic images (necessary to know relative position in order to determine 3-D position of object captured by both imagers), and the correlation of a feature from one image to the other in order to determine the positioning of the object capture by the imagers (paragraph 0086). It would have been obvious to one of ordinary skill in the art to modify the positional determination method described by Well using the subpixel method taught by Trew in view of Hu to increase the accuracy of the positional information (3-D position includes 2-D position information).*]

Instant claim 93: The method of claim 92, further comprising calculating a 3-dimensional position of the feature from the 2-dimensional position for the at least two images. [*See the discussion of claim 92.*]

Instant claim 94: The method of claim 61, further comprising determining coordinates of the feature within a second image, the position of the second image being known relative to the first image. [*See the discussion of claim 92.*]

Instant claim 95: The method of claim 61, further comprising determining a difference in position of the feature between the first image and at least one second image, wherein the at least one second image includes coordinates and has a position known relative to the first image. [*See the discussion of claim 92, wherein the difference between the feature position is an inherent part of determining the 3-D position of the object due to parallax between the stereoscopic imaging devices.*]

Instant claim 96: The method of claim 61, further comprising superimposing the first image and a second image to provide a superimposed image, wherein the position of the second image is known relative to the first image, and wherein the feature is substantially in registration. [*Regarding the relative positioning, see the discussion of claim 92. Additionally, the method of correlation taught by Trew in view of Hu inherently includes the overlaying (superimposing) of an image with the feature over the other image and iteratively calculating the correlation value shifting until the feature is in registration (highest correlation value).*]

Instant claim 97: The method of claim 61,wherein the method is applied for monitoring an aircraft structure. [*As per the discussion of claims 92-96, the use of a series of images to monitor and determine the position of an object has been taught, but the above cited prior art references*

do not teach the monitoring of an aircraft structure. However, one of ordinary skill in the art at the time of the invention would have expected the disclosed system to be capable of detecting targeted structures, objects, or features in a plurality of environments and situations not explicitly listed by the cited prior art that require the tracking or positional determination of an object using a plurality of imagers that have been taught by the above cited art.]

8. Claims 62-64, 66, and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Trew in view of Hu as applied to claim 61 above, and further in view of Pankratov (US 6208769).

Instant claim 62: The method according to claim 61, wherein each of the first and second determining steps comprise:

correlating the feature and the image using a predetermined correlation function to determine coordinates of the feature to the nearest pixel; [*As per the rejection of claim 61 Trew in view of Hu has taught the use of a correlation function to determine the coordinates of a feature with sub-pixel accuracy.*]

evaluating the correlation function at a plurality of pixel positions in the neighborhood of the determined coordinates to provide a plurality of values; [*Hu teaches in lines 35-45 of column 3 the further correlation of the image to determine the fractional pixel shift, but does not limit the correlation to pixels in the neighborhood of the determined coordinates. However, in calculating the correlation values of the image as a whole Hu also teaches the evaluation of*

correlation values within the neighborhood of the coordinates since they are included within the image being evaluated by the correlation function.]

fitting the plurality of values to a further function; and [*Hu does not teach fitting the result (often referred to as score) of the correlation function to an equation or surface. However, as is evidenced by the teachings of Pankratov the fitting of correlation functions to surfaces for the purpose of subpixel measurement was known to one of ordinary skill in the art (see column 3 lines 32-52 of Pankratov). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the correlation method of Hu to more accurately determine the subpixel positioning using the fitting and determining method taught by Pankratov.*]

differentiating the further function to determine its turning point, whereby coordinates corresponding to the turning point provide coordinates of the feature. [*Pankratov teaches the determination of the maximums (turning point) by differentiating the function and determining the points that make the functions equal to zero (see column 3 lines 42-45 of Pankratov).*]

Instant claim 63: The method according to claim 62, wherein the correlation function is evaluated at a plurality of sub-pixel positions. [*Pankratov teaches the evaluation of the function at regular intervals (column 5 lines 8-12 and figure 6 – points J, I, G, and H).*]

Instant claim 64: The method according to claim 63, wherein the sub-pixel positions are closer in proximity to the determined coordinates than the pixel positions. [*See figure 6 (Pankratov)*

points J, I, G, and H are closer to O (determined coordinates) than the pixel positions (points A, M, E, and D).]

Instant claim 66: The method according to claims 62, wherein the predetermined correlation function is a normalized greyscale correlation function. [*Pankratov teaches normalized correlation in lines 65+ of column 3. The normalized correlation is a shorthand reference to normalized greyscale correlation.*]

Instant claim 77: A method for determining coordinates of a feature comprising:

providing at least one image including the feature, the at least one image comprising a plurality of pixels; [*See the rejection of claim 61.*]

correlating the feature and the at least one image using a predetermined correlation function to determine coordinates of the feature to the nearest pixel; [*See the rejection of claim 62.*]

evaluating the correlation function at a plurality of sub-pixel positions in the neighborhood of the determined coordinates to provide a plurality of values and fitting the plurality of values to a further function; and [*See the rejection of claims 62-63.*]

differentiating the further function to determine its maximum, whereby coordinates corresponding to the maximum are coordinates of the feature to within a fraction of a pixel. [*See the rejection of claim 62 wherein the maxima occur at points when the differentiated function is zero (Pankratov).*]

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella, can be reached on 571-272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be

obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Matthew C Bella/

Supervisory Patent Examiner, Art Unit 2624